

Patent claims

We claim:

- 1 1. A temperature compensated actuator device comprising:
2 - a piezoelectric stack having first and second ends along a central axis and
3 having a first thermal expansion coefficient;
4 - a compensator arranged on one end of the piezoelectric stack comprising:
5 - a first member in form of a cylinder;
6 - a second member in form of a piston plate wherein the first member and the
7 second member are arranged movably along said axis with respect to each
8 other and define a hollow space between them; and
9 - a compensation member having a thermal expansion coefficient higher than
10 the first thermal expansion coefficient for filling said hollow space.
- 1 2. The actuator device as in claim 1, further comprising a top plate and a bottom
2 plate in between which said piezoelectric stack and said compensator are
3 arranged.
- 1 3. The actuator device as in claim 2, wherein said top plate comprises at least one
2 opening through which said piezoelectric stack can be electrically contacted.
- 1 4. The actuator device as in claim 1, wherein said piezoelectric stack comprises a
2 plurality of piezoelectric elements.
- 1 5. The actuator device as in claim 1, wherein said first member is a cup shaped
2 cylinder having an opening and said second member is a plate having an
3 elevated section which fits within said opening.
- 1 6. The actuator device as in claim 2, further comprising a tube spring coupling
2 said top and bottom plate for preloading said compensator.

- 1 7. The actuator device as in claim 6, wherein said tube spring is made of metal.
- 1 8. The actuator device as in claim 7, wherein the metal has a thermal coefficient
2 of about $11,5 \times 10^{-6}/K$.
- 1 9. The actuator device as in claim 1, wherein the first member comprises an inner
2 cavity and an opening, wherein a piston plate of said second member is
3 movably arranged within said cavity through said opening to define said
4 hollow space.
- 1 10. The actuator device as in claim 9, further comprising a spring arranged within
2 said cavity between said piston plate and said opening.
- 1 11. The actuator device as in claim 9, wherein the first member comprises two
2 parts which can be coupled via a connecting thread.
- 1 12. The actuator device as in claim 9, wherein the second member comprises two
2 parts which can be coupled via a connecting thread.
- 1 13. The actuator device as in claim 1, wherein the compensation member is made
2 of plastic having a high thermal expansion coefficient.
- 1 14. The actuator device as in claim 13, wherein the thermal coefficient is about
2 $100 \times 10^{-6}/K$.
- 1 15. The actuator device as in claim 1, wherein the first and second member are
2 made of metal.
- 1 16. The actuator device as in claim 15, wherein the metal has a thermal coefficient
2 of about $11,5 \times 10^{-6}/K$.

- 1 17. A fuel injector valve comprising:
2 - a body having an inner cavity for receiving a piezoelectric actuator, wherein
3 the cavity comprises an opening which forms a control valve by means of a
4 valve member which can be actuated by said piezoelectric actuator, wherein
5 the piezoelectric actuator device comprises:
6 - a piezoelectric stack having first and second ends along a central axis and
7 having a first thermal expansion coefficient;
8 - a compensator arranged on one end of the piezoelectric stack comprising:
9 - a first member in form of a cylinder;
10 - a second member in form of a piston plate wherein the first member and the
11 second member are arranged movably along said axis with respect to each
12 other and define a hollow space between them; and
13 - a compensation member having a thermal expansion coefficient higher than
14 the first thermal expansion coefficient for filling said hollow space.
- 1 18. The fuel injector valve as in claim 17, further comprising a top plate and a
2 bottom plate in between which said piezoelectric stack and said compensator
3 are arranged.
- 1 19. The fuel injector valve as in claim 18, wherein said top plate comprises at least
2 one opening through which said piezoelectric stack can be electrically
3 contacted.
- 1 20. The fuel injector valve as in claim 17, wherein said piezoelectric stack
2 comprises a plurality of piezoelectric elements.
- 1 21. The fuel injector valve as in claim 17, wherein said first member is a cup
2 shaped cylinder having an opening and said second member is a plate having
3 an elevated section which fits within said opening.

- 1 22. The fuel injector valve as in claim 18, further comprising a tube spring
2 coupling said top and bottom plate for preloading said compensator.
- 1 23. The fuel injector valve as in claim 22, wherein said tube spring is made of
2 metal.
- 1 24. The fuel injector valve as in claim 23, wherein the metal has a thermal
2 coefficient of about $11,5 \times 10^{-6}/K$.
- 1 25. The fuel injector valve as in claim 17, wherein the first member comprises an
2 inner cavity and an opening, wherein a piston plate of said second member is
3 movably arranged within said cavity through said opening to define said
4 hollow space.
- 1 26. The fuel injector valve as in claim 25, further comprising a spring arranged
2 within said cavity between said piston plate and said opening.
- 1 27. The fuel injector valve as in claim 25, wherein the first member comprises two
2 parts which can be coupled via a connecting thread.
- 1 28. The fuel injector valve as in claim 25, wherein the second member comprises
2 two parts which can be coupled via a connecting thread.
- 1 29. The fuel injector valve as in claim 17, wherein the compensation member is
2 made of plastic having a high thermal expansion coefficient.
- 1 30. The fuel injector valve as in claim 29, wherein the thermal coefficient is about
2 $100 \times 10^{-6}/K$.
- 1 31. The fuel injector valve as in claim 17, wherein the first and second member are
2 made of metal.
- 1 32. The actuator device as in claim 31, wherein the metal has a thermal coefficient
2 of about $11,5 \times 10^{-6}/K$.